AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) An apparatus comprising:

a plurality of input fibers, each of the plurality of input fibers configured to carry a plurality of lambda signals;

a first stack of substrates, each of the substrates coupled to one of the input fibers and configured to demultiplex the lambda signals carried on the input fiber by wavelength respectively;

a plurality of output fibers; and

an optical switching matrix configured to switch the demultiplexed lambda signals in the optical domain from the first stack of substrates to the plurality of output fibers without the need to convert the lambda signals to the electrical domain.

2. (Original) The apparatus of claim 1, further comprising a second stack of substrates coupled between the switching matrix and the output fibers, each of the substrates of the second stack configured to multiplex the switched lambda signals onto one of the output fibers respectively.

3. (Original) The apparatus of claim 1, wherein the switching matrix is wavelength dependent so that each of the plurality of lambda signals can be switched only between same wavelength channels on the input fibers and the output fibers respectively.

4. (Original) The apparatus of claim 3, wherein the switching matrix comprises a MEMS array of mirrors wherein the mirrors tilt along a first axis.

5. (Original) The apparatus of claim 4, wherein the switching matrix comprises a MEMS array of mirrors wherein the mirrors tilt along a second axis to compensate for misalignment.

6. (Original) The apparatus of claim 1, wherein the switching matrix comprises a MEMS array of mirrors configured to selectively tilt in one or two axis so as to equalize the power of the demultiplexed lambda signals from the first stack of substrates.

7. (Original) The apparatus of claim 1, wherein the switching matrix comprises a MEMS array of tilt-able mirrors formed voltages are used to control the tilt of the mirrors using electrostatic attraction.

8. (Original) The apparatus of claim 1, wherein each of the substrates of the first stack is a monolithic substrate.

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9. (Original) The apparatus of claim 1, wherein each of the substrates of the first stack comprise waveguide paths of unequal lengths.

10. (Original) The apparatus of claim 9, wherein the waveguide paths of unequal lengths are interconnected with star couplers.

11. (Original) The apparatus of claim 10, wherein the waveguide paths and the star couplers form a substantially symmetrical optical diffraction grating.

12. (Original) The apparatus of claim 1, wherein the each of the substrates of the first stack demultiplex the lambda signals by wavelength using a wavelength dependent optical index.

13. (Original) The apparatus of claim 1, wherein each of the substrates of the first stack demultiplex the lambda signals using interferometry.

14. (Original) The apparatus of claim 1, further comprising a lens array positioned between the first stack of substrates and the switching matrix, the lens array configured to generate a plurality of collimated optical beams from the demultiplexed lambda signals.

15. (Original) The apparatus of claim 14, wherein the lens array is formed on a monolithic substrate.

16. (Original) The apparatus of claim 1, further comprising an alignment plate mounted onto the first stack of substrates, the alignment plate configured to align the demultiplexed lambda signals into parallel collated beams.

17. (Original) The apparatus of claim 16, further comprising a lens array mounted onto the alignment plate.

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18. (Original) The apparatus of claim 16, wherein the alignment plate further comprises a plurality of detectors, the detectors configured to measure the power of the demultiplexed lambda signals tapped from the plurality of substrates of the first stack respectively.

19. (Original) The apparatus of claim 18, wherein the alignment plate further comprises a plurality of regions arranged at a predetermined distance with respect to the plurality of detectors, the regions further configured to be concentric with the demultiplexed lambda signals when the substrates of the first stack and the alignment plate are in alignment.

20. (Original) The apparatus of claim 18, wherein the plurality of detectors are photodiodes.

21. (Original) The apparatus of claim 17, wherein the lens array is integrated into the alignment plate.

22. (Original) The apparatus of claim 2, further comprising an alignment plate mounted onto the second stack of substrates, the alignment plate configured to provide aligned beams of switched lambda signals from the switching matrix to the inputs of the substrates of the second stack.

23. (Original) The apparatus of claim 22, wherein the alignment plate further comprises a plurality of detectors, the detectors configured to measure the power of the multiplexed lambda signals tapped and fed back from the plurality of substrates of the second stack respectively.

24. (Original) The apparatus of claim 23, wherein the alignment plate further comprises a plurality of regions arranged at a predetermined distance with respect to the plurality of detectors, the regions further configured to be concentric with the aligned beams of switched lambda signals when the plurality of second substrates in the stack and the alignment plate are in alignment.

25. (Original) The apparatus of claim 24, wherein the plurality of detectors are photodiodes.

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26. (Original) The apparatus of claim 2, wherein the second stack of substrates is arranged to multiplex switched lambda signals onto the output fibers and to demultiplex the lambda signals fed back through taps from the output fibers to the second stack of substrates respectively so that an alignment plate can be aligned with the second stack of substrates.

27. (Original) The apparatus of claim 1, further comprising a fixed mirror configured to receive lambda signals from the switching matrix and to reflect them back to the switching matrix.

28. (Original) The apparatus of claim 1, wherein the substrates of the first stack are configured to demultiplex lambda signals in different bands of amplification.

29. (Original) The apparatus of claim 28, wherein the different bands of operation include at least one of the following bands: band around 1310 nm, C and L bands around 1550 nm.

30. (Original) The apparatus of claim 28, further comprising amplifiers to amplify the lambda signals in the different bands of amplification.

31. (Original) The apparatus of claim 30, wherein the amplifiers are rare-earth doped fiber amplifiers.

32. (Original) The apparatus of claim 30, wherein the amplifiers are rare-earth doped waveguide amplifiers.

33. (Original) The apparatus of claim 30, wherein the amplifiers are integrated into the substrates.

34. (Original) The apparatus of claim 30, wherein the amplifiers are located on the input fibers.

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35. (Original) The apparatus of claim 30, wherein the amplifiers are located on the output fibers.

36. (Original) The apparatus of claim 28, further comprising an interleaver configured to separate the lambda signals in a selected band of amplification into subsets of interleaved lambda signals.

37. (Currently amended) A method of providing an optical switch comprising:

providing a plurality of input fibers, each of the plurality of input fibers configured to carry a plurality of lambda signals;

providing a first stack of substrates, each of the substrates coupled to one of the input fibers and configured to demultiplex the lambda signals carried on the input fiber by wavelength respectively;

providing a plurality of output fibers; and

providing an optical switching matrix configured to switch the demultiplexed lambda signals in the optical domain from the first stack of substrates to the plurality of output fibers without the need to convert the lambda signals to the electrical domain.

38. (Original) The method of claim 37, further comprising providing a second stack of substrates coupled between the switching matrix and the output fibers, each the substrates of the second stack configured to multiplex the switched lambda signals onto one of the output fibers respectively.

39. (Original) The method of claim 37, wherein the provided switching fabric is a MEMS array of tilt-able mirrors wherein the mirrors scan primarily along one axis.

40. (Original) The method of claim 37, wherein the provided switching fabric is a MEMS array of tilt-able mirrors wherein the mirrors selectively scan along one or two axis so the MEMS array is capable of equalizing the power of the demultiplexed lambda signals from the first stack of substrates during operation.

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41. (Original) The method of claim 37, further comprising providing a first alignment plate to align the first stack of substrates.

42. (Original) The method of claim 38, further comprising providing a second alignment plate to align the second stack of substrates.

43. (Original) The method of claim 37, wherein each of the provided substrates of the first stack are array waveguide gratings.

44. (Original) The method of claim 37, further comprising providing a fixed mirror configured to receive lambda signals from the switching matrix and to reflect the lambda signals back to the switching matrix.

45. (Original) The method of claim 37, further comprising providing a plurality of the optical switches to form a scalable cross-connect.

46. (Currently amended) A method for assembly of an optical switch, comprising:

stacking a first plurality of substrates into a first stack, each of the first plurality of substrates in the first stack capable of receiving input lambda signals and providing demultiplexed output signals;

aligning the first plurality of substrates in the first stack by positioning each of the first plurality of substrates to a position where a plurality of detectors on an alignment plate measure the maximum signal power of the demultiplexed output lambda signals from each of the first plurality of substrates respectively; and

adhering the first plurality of substrates and the alignment plate together when alignment of the first plurality of substrates of the first stack is achieved.

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47. (Currently amended) The method of 46, further comprising:

stacking a second plurality of substrates into a second stack, each of the second plurality of substrates in the second stack capable of receiving switched lambda signals and providing multiplexed output lambda signals;

aligning the second plurality of substrates in the second stack by positioning each of the second plurality of substrates to a position where a second plurality of detectors on a second alignment plate measure the maximum signal power of the multiplexed output signals lambda from each of the second plurality of substrates respectively; and

adhering the second plurality of substrates and the second alignment plate together when alignment of the second plurality of substrates of the second stack is achieved.

48. (Original) The method of claim 46, wherein the alignment of the first plurality of substrates is performed one substrate at a time.

49. (Original) The method of claim 48, wherein the alignment of the first plurality of substrates is performed in parallel.

50. (Currently amended) The method of claim 46, wherein the plurality of detectors on the alignment plate measure the maximum signal power from the demultiplexed output lambda signals from taps configured on the first plurality of substrates respectively.

51. (Currently amended) The method of claim 47, wherein the second plurality of detectors on the second alignment plate measure the maximum signal power from the multiplexed output lambda signals from taps configured on the second plurality of substrates respectively.

52. (Currently amended) A cross-connect, comprising:

a plurality of optical switches, each of the optical switches configured to receive a plurality of input fibers each configured to carry a plurality of lambda signals within a selected band of amplification respectively, each of the optical switches further comprising:

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a first stack of substrates, each of the substrates coupled to one of the input fibers and configured to demultiplex the lambda signals carried on the one input fiber by wavelength respectively;

a plurality of output fibers; and

an optical switching matrix configured to switch the demultiplexed lambda signals in the optical domain from the first stack of substrates to the plurality of output fibers without the need to convert the lambda signals to the electrical domain.

53. (Original) The cross-connect of claim 52, wherein each of the optical switches further comprising a second stack of substrates coupled between the switching matrix and the output fibers, each of the substrates of the second stack configured to multiplex the switched lambda signals onto one of the output fibers respectively.

54. (Original) The cross-connect of claim 52, wherein an alignment plate is used to align the first stack of substrates.

55. (Original) The cross connect of claim 53, wherein an alignment plate is used to align the second stack of substrates.

56. (Original) The cross-connect of claim 52, wherein the selected band of amplification includes one of the following bands of amplification: 1310 nanometers, 1550 nanometers; C band or L band.

57. (Original) The cross connect of claim 52, wherein at least one of the optical switches further comprises an interleaver to divide the selected band of amplification of the one optical switch into sub-bands of amplification.

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58. (Original) The cross-connect of claim 52, further comprising amplifiers to amplify the lambda signals in the different bands of amplification.

59. (Original) The cross-connect of claim 58, wherein the amplifiers are rare-earth doped fiber amplifiers.

60. (Original) The cross-connect of claim 58, wherein the amplifiers are rare-earth doped waveguide amplifiers.

61. (Original) The cross-connect of claim 58, wherein the amplifiers are integrated into the substrates.

62. (Original) The cross-connect of claim 58, wherein the amplifiers are located along the input fibers.

63. (Original) The cross-connect of claim 58, wherein the amplifiers are located along the output fibers.

64. (New) An apparatus, comprising:

a plurality of input fibers, each of the input fibers configured to carry a plurality of lambda signals;

a first stack of substrates, each of the substrates coupled to one of the input fibers and configured to demultiplex the lambda signals carried on the input fiber by wavelength respectively using waveguide paths of unequal length;

an array of lenses configured to produce a first set of collimated optical beams from the demultiplexed lambda signals,

a switching matrix including a first MEMs array and a second MEMs configured to switch the spatial position of the first set of collimated optical beams to produce a second set of collimated optical beams;

an output lens array to produce converging optical beams from the second set of collimated optical beams;

a second stack of substrates configured to combine multiple optical beams of different lambdas onto a plurality of output fibers from the converging optical beams from the second set of collimated optical beams; and

an element configured to equalize the power of the demultiplexed lambda signals at the output of the second stack of substrates.

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